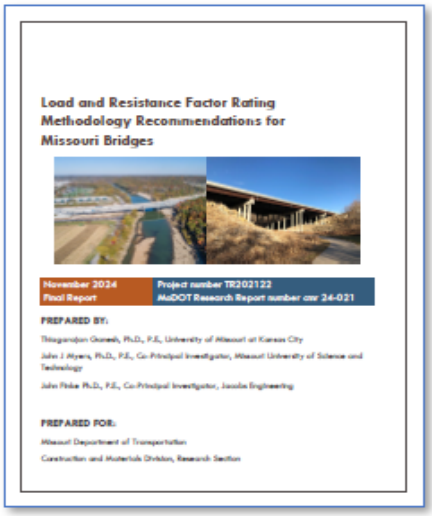
For more information contact: Jenni Hosey (573) 526-4493

Research Summary

Load and Resistance Factor Rating Methodology Recommendations for Missouri Bridges



Traditionally, the Missouri Department of Transportation (MoDOT) has performed bridge load ratings using a method called load factor rating (LFR). With changes to bridge design and heavier vehicles traveling Missouri's highways, MoDOT is working to adopt an updated system called load and resistance factor rating (LRFR). The primary goal of this study is to develop and recommend load posting policies using the LRFR method that are consistent with the current LFR policy.

The study has shown that LFR and LRFR differ in (a) bridges analyzed in LFR govern in interior girders while when using LRFR, most bridges will govern in the exterior girders; (b) LRFR ratings are lower than LFR ratings; (c) the number of posted bridges increased for LRFR over those required to be posted by compared to using LFR. This suggests possible changes to the LRFR posting thresholds to better mesh with current MoDOT practices.

Steel Bridges: Use of the current thresholds for commercial zone single unit (CZSU) and commercial zone relay truck (CZRT) seems very conservative and leads to more bridges being posted. The research suggests that posting thresholds used for CZSU (45 tons) and CZRT (70 tons) within the commercial zones should be reduced to their gross weight (GWT) of 40.8 tons and 51 tons, respectively. The H20L model, the current live load model for LFR, has a posting threshold of 30 tons and is recommended to be revised to 31 tons in LRFR.

Changing the Service II limit state factor from 1.3 to 1.0 showed a significant reduction, up to 30%. For bridges that have spans greater than 200 feet, most MoDOT vehicles still envelop American Association of State Highway Transportation Officials (AASHTO) vehicles, while some will require a factor. Generally, truck trains have the lowest rating loads and, therefore, govern by being the most conservative in both the LRFR and LFR.

The ratings for multi-lane loaded bridges are more conservative than the single-lane loaded bridges when using both LFR and LRFR.

"The primary goal of this study is to develop and recommend load posting policies using the LRFR method that are consistent with the current LFR policy."

Prestressed Concrete Bridges: The study shows no significant difference in rating load and number of bridges requiring posting when using LFR or LRFR.

When using LRFR for prestressed bridges and the seven vehicles enveloped, thresholds ranging from 25-40 tons and factors ranging from 0.87 to 1.0 are recommended for H20L, MO3S2, and CZRT. There are only six bridges from the sample of 100 prestressed bridges that have load ratings controlled by the Service III limit state.

Reinforced Concrete Bridges: For H20L, a threshold of 31 tons with 0.97 factor is recommended to encapsulate vehicles operated within the state. Similarly, a threshold of 40 tons with a factor of 0.93 is proposed for the MO3S2 vehicle. For the MoDOT commercial single-unit truck CZSU, a threshold of 40.8 tons with a factor of 0.92 is proposed for the MO3S2 vehicle. Lastly, a threshold of 51 tons with a factor of 1 is proposed for the MoDOT commercial vehicle CZRT.

Culverts: All but three of the 35 concrete culverts analyzed in this study used allowable stress design (ASD). By comparing LFR and LRFR for the H20L and MO3S2 vehicles, the study concluded that LFR has higher rating factors and rating loads than LRFR. There were two culverts in commercial zones subject to CZSU and CZRT, making it difficult to develop conclusions about rating trends. Despite the lack of data, the available points parallel a trend. As was the case with H20L and MO3S2, the load rating results for LRFR were about 65%-70% compared to rating loads in LFR.

Figure 1: A bridge over the river.

Project Information

PROJECT NAME: TR202122—Load and Resistance Factor Rating Methodology Recommendations for Missouri Bridges

PROJECT START/END DATE: June 2021-July 2024

PROJECT COST: $184,999

LEAD CONTRACTOR: Missouri Center for Transportation Innovation

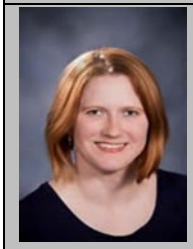
PRINCIPAL INVESTIGATOR: Ganesh Thiagarajan and John Myers

REPORT NAME: Load and Resistance Factor Rating Methodology Recommendations for Missouri Bridges

REPORT NUMBER: cmr 24-021

REPORT DATE: June 2024

Project Manager



CONTACT INFORMATION:

Jenni Hosey
Senior Research Analyst
Missouri Dept. of Transportation
1617 Missouri Blvd.
Jefferson City, MO 65109
(573) 526-4493
Jennifer.J.Hosey@modot.mo.gov